

This print-out should have 7 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

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**Serway CP 09 03**

**001 10.0 points**

The heels on a pair of women's shoes have radii of 0.45 cm at the bottom.

If 33% of the weight of a woman weighing 515 N is supported by each heel, find the stress on each heel.

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**Lighthouse Pendulum**

**002 10.0 points**

A visitor to a lighthouse wishes to determine the height of the tower. She ties a spool of thread to a small rock to make a simple pendulum, which she hangs down the center of a spiral staircase of the tower. The period of oscillation is 10 s.

The acceleration of gravity is  $9.8 \text{ m/s}^2$ .

What is the height of the tower?

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**Gravity on a New Planet**

**003 10.0 points**

Having landed on a newly discovered planet, an astronaut sets up a simple pendulum of length 1.18 m and finds that it makes 140 complete oscillations in 664 s. The amplitude of the oscillations is very small compared to the pendulum's length.

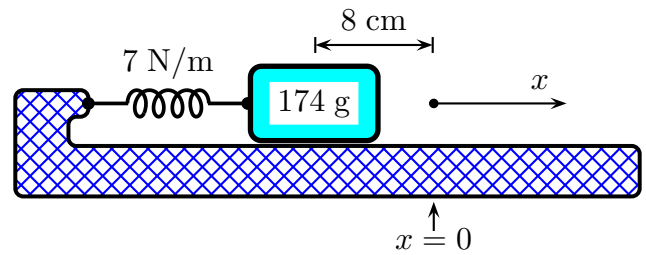
What is the gravitational acceleration on the surface of this planet?

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**Oscillation on a Spring**

**004 (part 1 of 3) 10.0 points**

A 174 g mass is connected to a light spring of force constant 7 N/m that is free to oscillate on a horizontal, frictionless track. The mass is displaced 8 cm from the equilibrium point and released from rest.



Find the period of the motion.

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**005 (part 2 of 3) 10.0 points**

What is the maximum speed of the mass?

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**006 (part 3 of 3) 10.0 points**

What is the maximum acceleration of the mass?

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**Steel Cable 02**

**007 10.0 points**

A tugboat tows a ship using a steel cable. The maximal strain the cable may sustain without breaking is 0.037. Suppose the drag exerted on the towed ship by the water is  $4.5 \times 10^6 \text{ N}$  and the tugboat is using the thinnest steel cable that would do the job (no safety margin).

What is the diameter of this cable? The Young's modulus of steel is  $2 \times 10^{11} \text{ Pa}$ .

Correct answer: 0.0278257 m.